

Calmuo Shift Tutorial: The Muon System

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- The Hardware
- Control Applications
- Troubleshooting

this tutorial can be found on the calmuo shift webpage:
<http://www-d0online.fnal.gov/www/groups/calmuo/> under “useful links”



The D0 Muon System

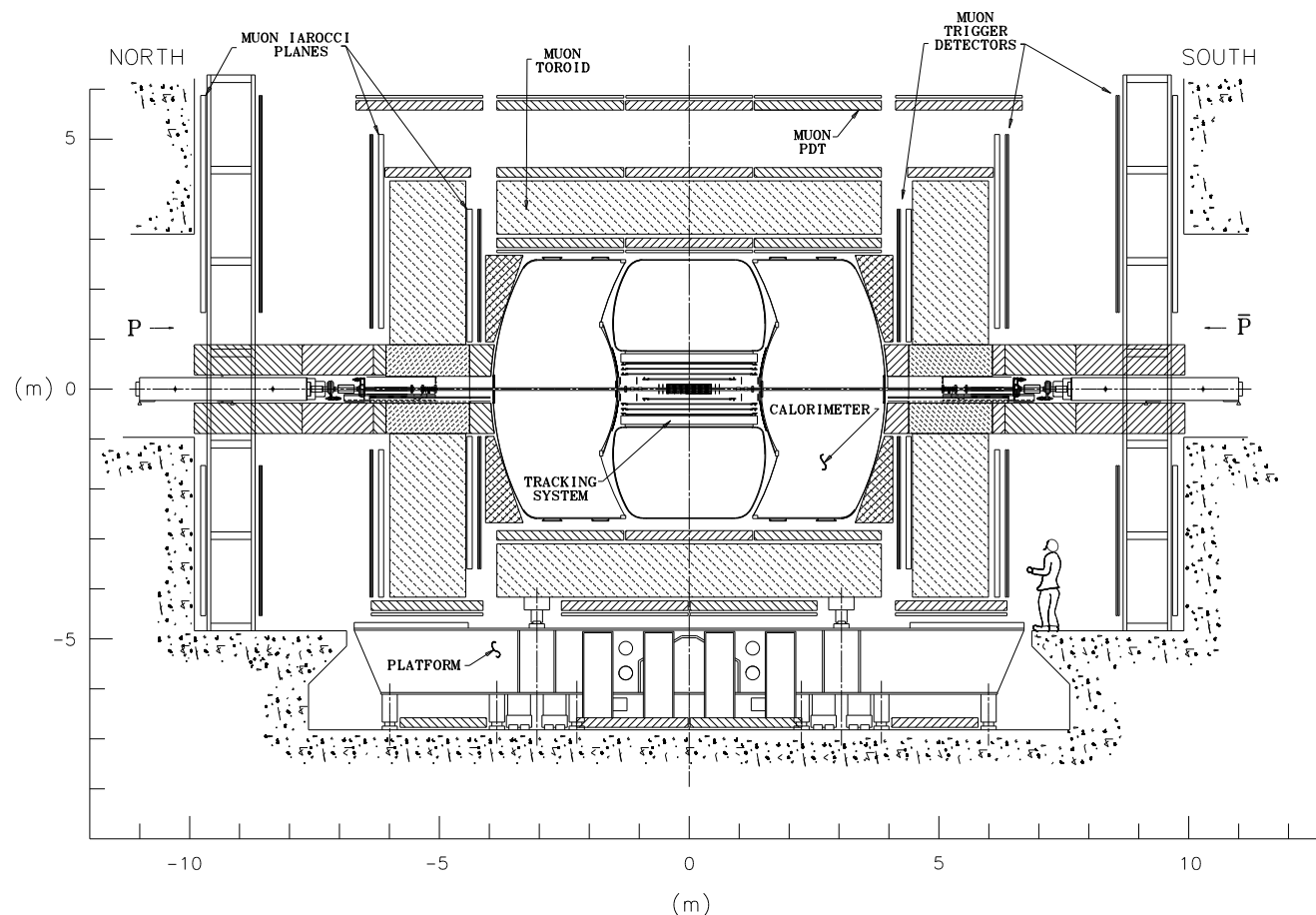
central: **Central Drift Chambers** **Central Scintillation Counters** ($|\eta| < 1$)

forward region:

**Forward
Mini-Drift Chambers**

**Forward
Scintillation Counters**

($1 < |\eta| < 2$)





The Muon Subsystems

Central Muon System:	WAMUS – Prop. Drift Chambers (PDTs) Central Scintillation Counters (CSC)
Forward Muon System:	FAMUS – Mini Drift Chambers (MDTs) Forward Scintillation Counters (FSC) – Pixels
Trigger:	L1 Muo



Hardware Locations

- Readout crates: Movable Counting House 3rd floor (MCH3)
- High Voltage power supplies: Movable Counting House 2nd floor (MCH2)

(shifter may need to powercycle those crates, e.g. after a power failure)



Muon: tasks during calmuo shift (1)

- **general**

D0 data taking → as efficient as possible
read documentation / get used to control applications
know potential problems
be aware of what's happening around you ...
relevant events → electronic logbook

- **shift begin**

previous shifter → current status
recent problems / special situations for specific subsystems
shift captain → general D0 status
make sure that all control applications are running
and check that no (unknown) errors are present



Muon: tasks during calmuo shift (2)

- **at the begin of a store**
after store scraping is completed: ramp Muon high voltages to 100% (full)
check that there are no alarms
- **at the begin of a new run**
start "muo_examine" and the "histo" program
start to fill out the muon run checklist for the new run → use checklist GUI
cal: start "cal_examine", "L1Cal_examine" and the "histo" programs
- **while a run is in progress**
keep an eye on the alarm display / check the muo-examine histograms
regularly / check the resource monitors for the subsystems
cal: monitor hot cells — kill hot cells using "HotCellKiller"



Muon: tasks during calmuo shift (3)

- **at the end of a run**

archive the histograms (muon **and cal**) in the electronic logbook
after you have prepared everything for the new run:
complete the checklist for the last run

- **at the end of a store**

after the shift captain has informed you that the data collection is completed:
ramp all muon high voltages to STANDBY
(yes: the PDT pads the standby value is equal to full value!)
cal: do not change the calorimeter HV!!!! — never change cal HV!!!

- **in between stores**

keep the system running
check for problems during zero-bias run: run the examine programs



Muon System: Control Applications

webpage: <http://www-d0online.fnal.gov/www/groups/calmuo/>

- documentation on the web \Rightarrow
- Logbook
- Readout Client
- Alarm Display
- HV display
- Resource Monitors

D0 Muon System Group Homepage - Mozilla

File Edit View Go Bookmarks Tools Window Help

Back Forward Reload Stop <http://www-d0online.fnal.gov/www/groups/calmuo/> Search Print

Home Bookmarks SGI... WebMail Calendar Radio People Yellow Pages Download Channels

Account management - D0CALMUO D0 Muon System Group Homepage

What to do during Calorimeter/Muon Shift

This page is not maintained for calorimeter. Only the calorimeter paper manual contains information.

phase	calorimeter	muon
in general	<ul style="list-style-type: none">make sure that the D0 data taking is as efficient as possible and the quality is high. Therefore:<ul style="list-style-type: none">read the available calorimeter and muon documentationget used to the control applicationsbe aware of potential problems so that you can quickly find solutionsmake sure that relevant information are written into the electronic logbookcontact experts in the case of problems	
at the begin of your shift	<ul style="list-style-type: none">talk to the previous shifter about the status of the calorimeter and muon systems - learn about recent problems and whether there are special situations for specific subsystems and how to handle themtalk to the shift Captain about the general status and plans of data taking for D0	
at the begin of a store	<ul style="list-style-type: none">Download cal_prepare_for_run (see calorimeter paper manual)	<ul style="list-style-type: none">after the shift captain has informed you that the store scraping is completed: ramp all Muon high voltages to 100% (full) - a description of the HV GUI is here
at the begin of a new run	<ul style="list-style-type: none">check on the "COORMON" window that the run has started and is collecting eventsstart to fill out the run checklist for the new run	<ul style="list-style-type: none">check that there are no major alarms
while a run is in progress	<ul style="list-style-type: none">see calorimeter paper manual	<ul style="list-style-type: none">start "muo_examine" and the "histo" programs
after the run stops	<ul style="list-style-type: none">monitor the alarm display and take actions accordinglycheck detector operation in calorimeter control programs (see calorimeter paper manual) and muo_examinemonitor the resource monitors for all subsystemsput observations into the logbook	<ul style="list-style-type: none">save the histograms and the completed run checklist in the electronic logbookstop muo_examine
at the end of a store	<ul style="list-style-type: none">do not change the calorimeter HV	<ul style="list-style-type: none">after the shift Captain asks you to power down muon HV.



The CalMuo Webpage

direct access to all documentation:

how to operate:

- Readout Client
- HV GUI
- alarm display

information on muon subsystems:

- MDT / Pixel
- PDT / L1muo





Muon Shift Web Documentation

- **purpose:**
provide *basic* knowledge about the muon system
and the muon control applications that helps
to *identify* and *locate* problems.
- **only very limited:** solve problems
- **real problems:**
shifters task: call/page experts!
all decisions have to be made by experts
(e.g. disable crates from readout)



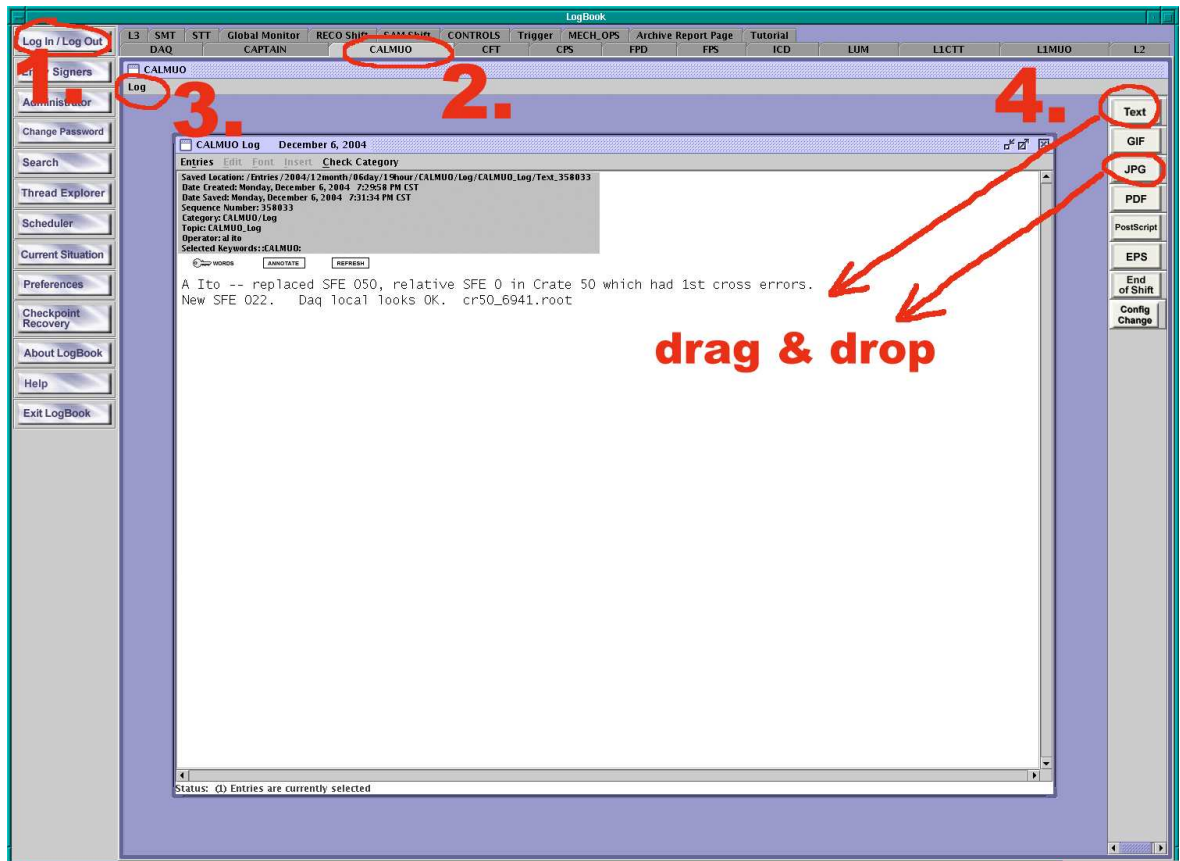
The Electronic Logbook

important: communication
between shifters
and experts

all relevant events
→ logbook

make sure that experts
make notes about
their work

practical aspect:
only use .jpg pictures
smaller storage size
faster remote access



→ sign up for logbook account before your first shift (ask M. Wobisch or DAQ shifters)



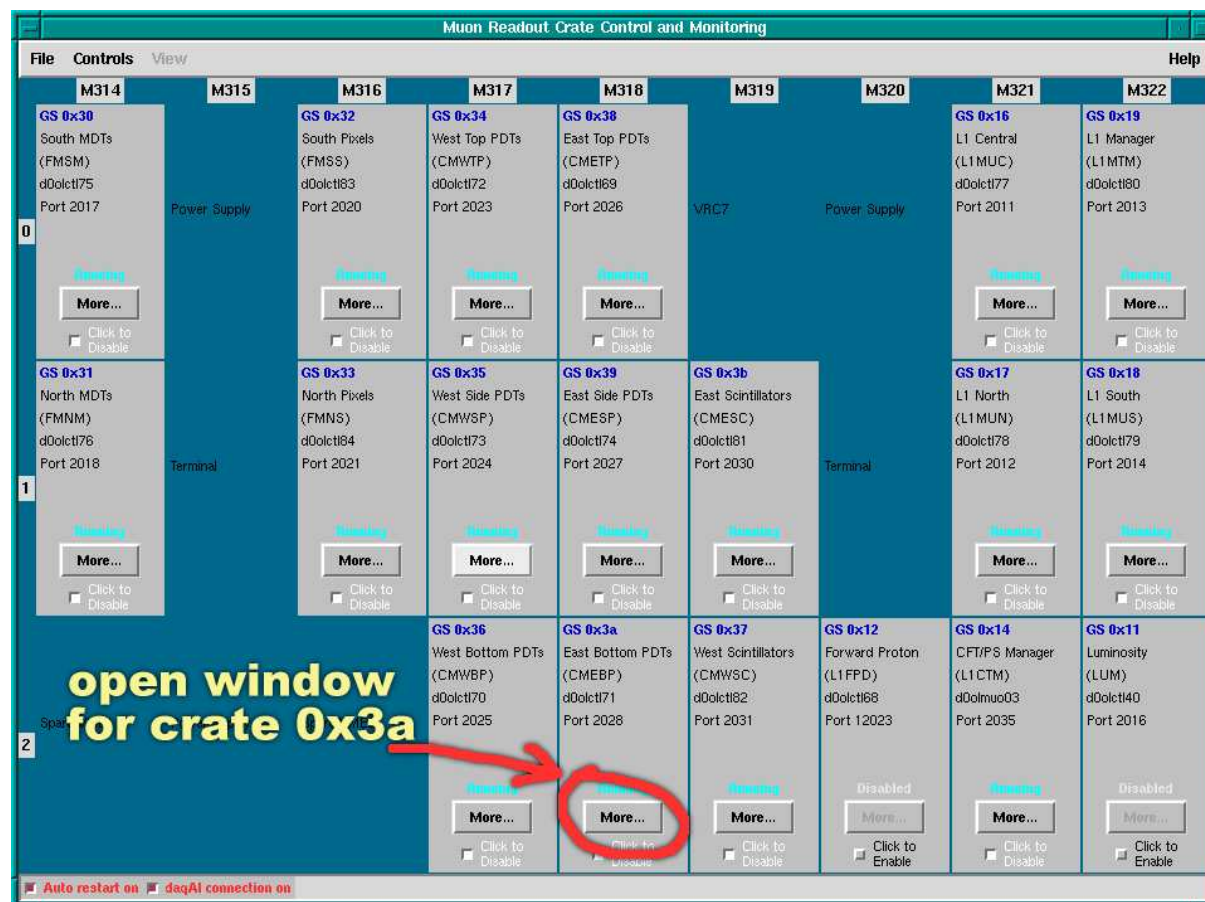
The Readout Client (1)

GUI layout corresponds to physical layout of the readout crates in MCH3

overview on the muon readout status

indicates:

stable readout
(blue: "Running")
readout errors (red)
and/or deviations from
the default configuration
(yellow)



→ press button: **More ...** to access to detailed information for single readout crates

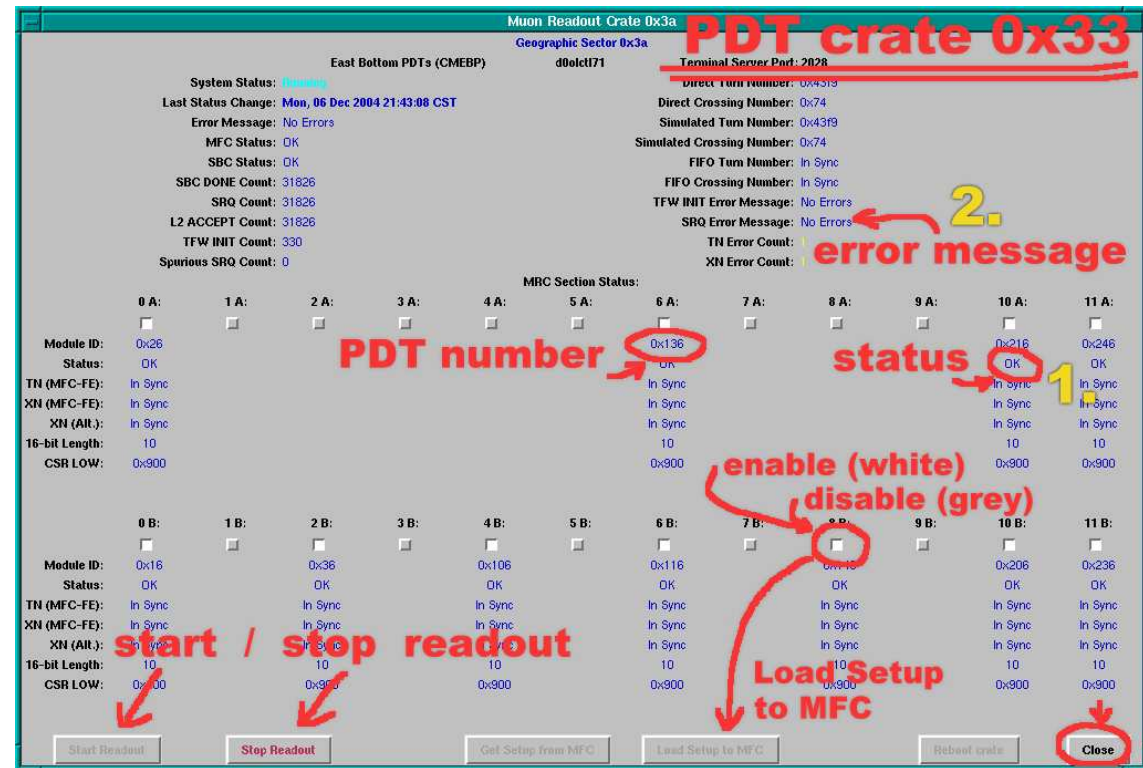


The Readout Client (2)

readout status of single muon crate (check status)

after crash: **STOP** and **START** check field (1.) to identify the section which caused the crash note the error message (2.)

never **REBOOT** crate (call Readout expert if needed)



excluding sections when they crash at the first event: **only after contacting the experts!!**
STOP readout —disable channel —**Load Setup to MFC** —**START** again

when in-/excluding channels: they also **must** be in-/excluded from L1 and L2
see “Muon” → “Troubleshooting” → “How to Disable a Muon Section ...”
(after disabling: reinit Coord)



The Muon Alarm Display

	MAJOR	MINOR	INVALID	ACKED	DISABLED	GOOD
Run Pause	0	0	0	0	0	0
HV	0	378	0	0	0	0
MDT	0	0	3	0	0	0
PDT	0	0	0	0	0	0
SRC	0	0	0	0	1	0
L1	0	1	0	0	0	0
PROC	0	0	0	0	0	0
Power	0	0	0	0	0	0
All Muon	0	379	9	0	1	0

Status: Connection to server started

check regularly!!! (keep running below the readout client)

- often the easiest way to identify problems / click on fields for more information
- (1.) Major Alarm \Rightarrow call/page expert! (while waiting for expert: try to understand)
- (2.) Acknowledge: acknowledge **single** occurrence / fluctuating alarms will return
- (3.) disable: completely ignored / if a minor alarm becomes major you won't see it

\rightarrow **never acknowledge/disable** alarms without contacting an expert



The Muon HV Display (1)

first page:

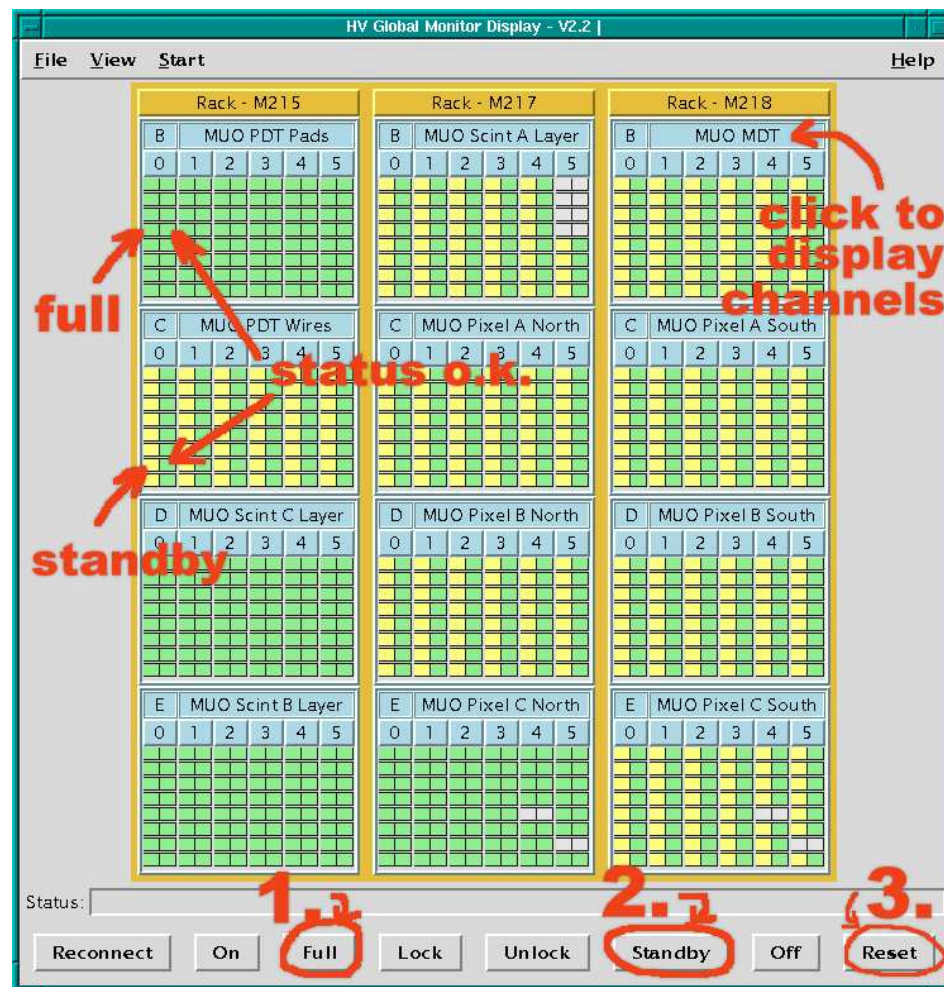
overview on all channels
for all muon subsystems
(more details:
click on channel name)

left column:

green: 100%
yellow: standby
red: trip

right column:

green, if setting corresponds
to nominal setting



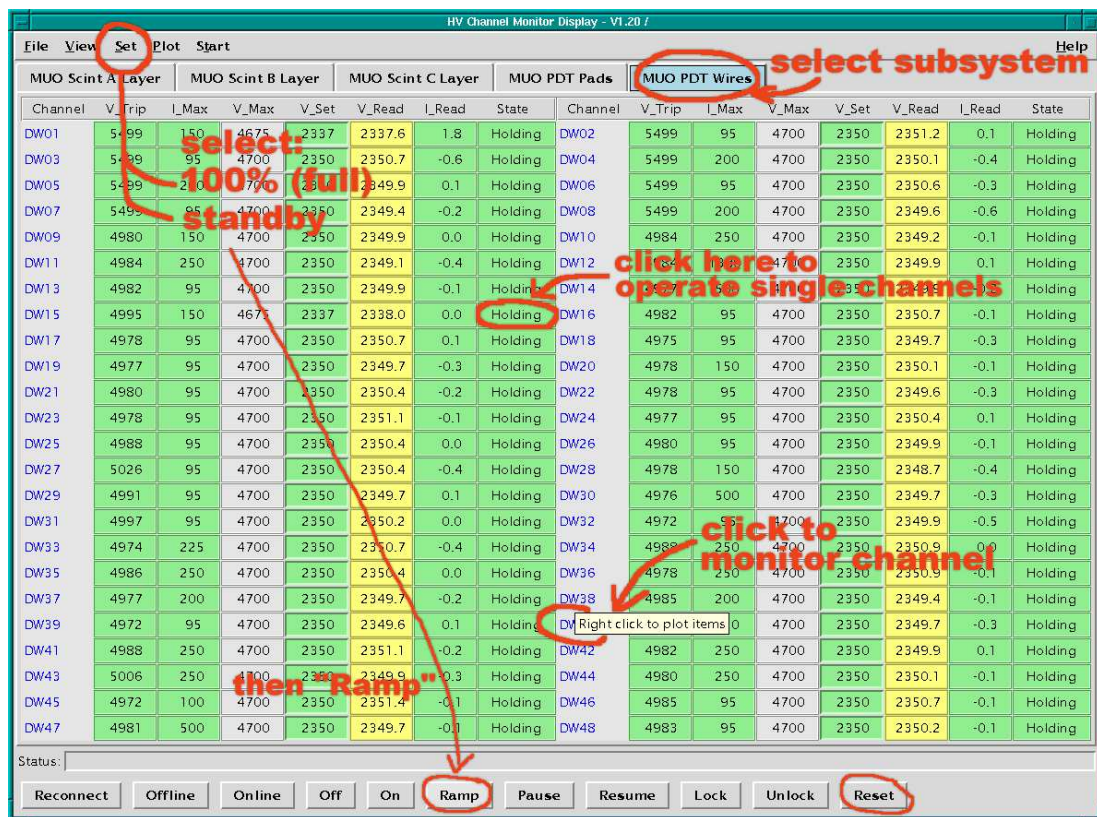
⇒ ramp/reset all muon HV channels by pushing a single button (1., 2., 3.)

important!!! ⇒ check that ramping was successful (in rare cases: single channels don't ramp)

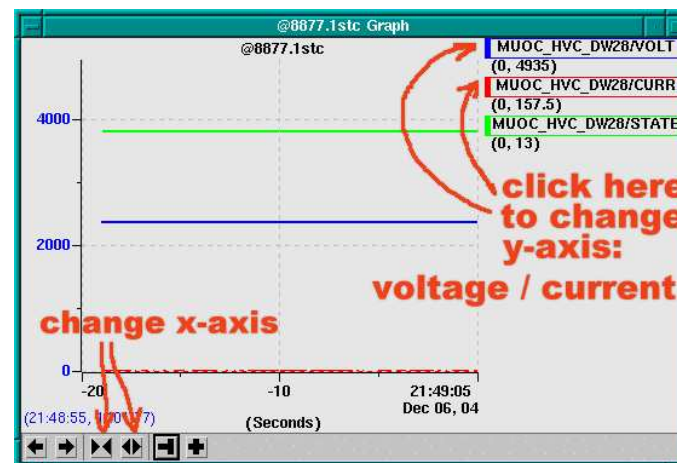


The Muon HV Display (2)

two detailed displays: complete infos on single channels



helpful for troubleshooting:
monitor voltage and current
for single channels



(example of a good HV channel - no peaks)
important to check after HV trip!

allows to ramp single channels \Rightarrow helpful after trips



The Resource Monitors: PDTs

“hidden” buttons:

give detailed info on alarms

→ very important to check
whenever alarm occurred

usually status field: **NORMAL**

when status field is red:

click on **ALARM** for
more information

⇒ write into logbook

→ always check after readout crashed to identify source for an error

⇒ This is what experts need to know when paged at 2:00am!!!

select

click to check

**in cases of errors: "reset"
(run needs to be paused)**

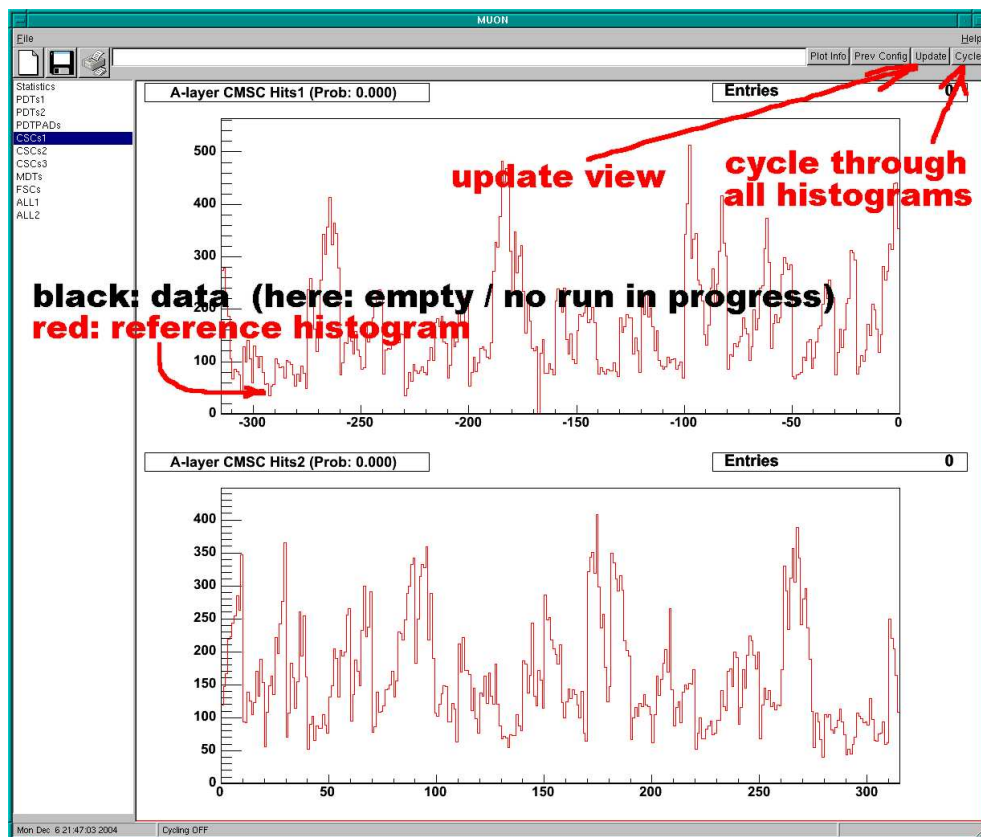
Octant 0	Octant 1	Octant 2	Octant 3	Octant 4	Octant 5	Octant 6	Octant 7					
PDT Name	+5 Digital	+5 Analog	-5 Digital	-5 Analog	Temp	Pressure	Status	Control	Power			
Layer A												
MUO_PDT_015	4.98	5.46	-5.01	-5.54	10.40	3.94	Normal	Normal	On	Clear	Reset	
MUO_PDT_025	5.02	5.39	-4.98	-5.54	26.00	4.45	Normal	Normal	On	Clear	Reset	
MUO_PDT_035	5.02	5.33	-4.91	-5.45	20.40	4.90	Normal	Normal	On	Clear	Reset	
Layer B												
MUO_PDT_105	5.02	5.53	-5.01	-5.38	15.60	1.15	Normal	Normal	On	Clear	Reset	
MUO_PDT_115	4.98	5.33	-4.85	-5.45	21.20	4.70	Normal	Normal	On	Clear	Reset	
MUO_PDT_135	4.88	5.39	-4.85	-5.48	20.40	4.50	Normal	Normal	On	Clear	Reset	
MUO_PDT_145	4.98	5.56	-4.95	-5.51	19.20	4.40	Normal	Normal	On	Clear	Reset	
Layer C												
MUO_PDT_205	4.98	5.46	-4.95	-5.41	14.80	0.83	Normal	Normal	On	Clear	Reset	
MUO_PDT_215	4.98	5.46	-4.95	-5.48	22.00	1.18	Normal	Normal	On	Clear	Reset	
MUO_PDT_235	4.88	5.52	-4.98	-5.54	22.00	0.99	Normal	Normal	On	Clear	Reset	
MUO_PDT_245	5.02	5.52	-4.88	-5.60	19.60	1.06	Normal	Normal	On	Clear	Reset	

Status:

Reconnect Clear Reset



MuoExamine and Browser



instructions how to run examine and the browser are on the webpage and posted in the controlroom

⇒ run examine all the time to and compare to the reference histograms in red

most important: check for empty (=dead) channels
(some fluctuations can always occur)



The Calmuo Run Checklist GUI

purpose:

archive cal & muo system
status for every run

start/operate as described on web page

some general information

(filled automatically
after inserting the run number)

some system details:

- tripped HV channels
- sections excluded from readout
- hot calorimeter cells

store in logbook –
together with examine plots

The screenshot shows the 'Calmuo Run Checklist' window. At the top, there's a menu bar (File, Edit, View, Settings, Help) and a toolbar with 'Reset Form', 'Save', 'Save and Print', and 'Quit'. A yellow banner at the top says 'Beam/Detector Status (** NOTE **: Enter Run Number then <CR> to get run information)'. Below this, there are sections for 'Required fields indicated by *', 'Muon Checklist', 'Calorimeter checklist', and 'Examine Plots'. Red annotations include: a circle around 'Reset Form' with a '1.' next to it; a red arrow pointing to the 'Run #' field with a '2.' next to it; a red arrow pointing to the '& "RETURN"' text; a green circle around the 'Store Number' and 'Prescale file' fields with the text 'filled automatically' inside; and red arrows pointing to the 'Muon L1 trigger bits rates' section. The 'Muon Checklist' section includes fields for HV PIXELS, HV Central A&C, HV WAMUS Pads, and HV Channels OFF. The 'Calorimeter checklist' section includes fields for Calorimeter HV Trips, Calorimeter Pre-Amps On, Calorimeter Hot Cells, and Calorimeter Alarms. The 'Examine Plots' section includes fields for Cal Examine Output, Muon Examine Output, L1 Cal Examine Output, and All Plots for the run attached to checklist. At the bottom, there's a 'Shifter Comments' text area.



“frequent” errors

- HV failures → trips
 - ⇒ reset & ramp again (a few times)
 - check correlation with high background
 - frequent ⇒ call expert
- crashes of readout crates
 - note section in logbook / keep statistics of frequency
 - always the same section??
 - so frequent that it disturbs overall data taking??
 - ⇒ call expert / probably bad section has to be taken out of the readout
 - important:** this section also has to be excluded from L1 and L2
 - exclude from L1: shifter’s task (guided by expert)
 - exclude from L2: automatically after DAQ shifter has reinitialized Coor
- major alarm: one PDT shows L1 error + FEB error (not a big deal!!!)
 - try to reset once (on PDT resource monitor / after run is paused)
 - call/page PDT expert (expert will ask you to disable both alarms & keep running)



conclusions

- operations of the muon system is pretty stable
- allows shifters to concentrate on “details” \leftrightarrow absolutely necessary to guarantee operation at high efficiency
- shifters documentation in a good shape
still not “complete” —but is constantly improved
- feedback from shifters has helped to set up documentation
 \Rightarrow important for future progress
- this tutorial provides useful information on the muon system operation — but really important: before your first shift you must have one or two “shadow shifts” (together with experienced shifter)
- **BIG THANKS to the shifters!**